Comments:

Luke Golden
Department of Environmental Quality
Water Resources Division
Jackson, MI 49201

Please see our fisheries biologists comments below. During our site inspections on stream crossings it was mentioned that a biologist has assessed and completed surveys on all stream crossings? Could we please be given the habitat assessments performed for not only mussels but any other T&E concerns if there have been documentation on them throughout the Michigan Stretch so we can include them as well into the public notice?

Jeffrey Braunscheidel
Senior Fisheries Biologist, Lake Erie Mgmt Unit
(248) 666-7445

I've listed below some stream crossings that we have some concerns with due to listed species or other factors. Those sites listed with an asterisk we are requesting receive some sort of mussel survey to evaluate whether relocation efforts are necessary.

Lenawee County:

- Bear Creek (mi 34.3) – Slippershell mussel (T) found less than 2 miles downstream in 2001.
- *S. Br. River Raisin (mi 39.76) – Slippershell mussel found in vicinity in 2001. At least minimal mussel survey.
- *Wolf Creek (mi 42.79 & 43.75) – several state listed mussels found less than 2 miles upstream (see next site). Mussel survey.
- *Wolf Creek (mi 44.52) – several state listed mussels found immediately upstream in 2001 including Slippershell (T), Elktoe (SC), Rainbow (SC), Round pigtoe (SC), & Wavyrayed lampmussel (T). Mussel survey. Request serious consideration be given to crossing method and consider mussel relocation effort here if not bored or drilled and mussel survey verifies mussel presence.
- *Black Creek (mi 44.95) – proximity to Wolf Ck mussels warrants at least a look for mussels here. Mussel survey.

Washtenaw County:

- *Iron Creek (mi 58.29) – several listed mussels in vicinity in 2001 including Slippershell (T), Round pigtoe (SC), & Wavyrayed lampmussel (T). Mussel survey.
- Raisin River at Austin Rd – Several listed mussels and fish species present here. Concerns covered by HDD crossing method, but extra care needed to protect against slurry blowout.
- Mill Creek (mi 72.19) – Slippershell found in 1935. Stream is rather large and now supporting a brown trout population just downstream. Request crossing method consideration to something with minimal sediment release.
- N. Fork Mill Creek (mi 73.93) – Same as for Mill Creek, consider crossing method to minimize sediment release.

Livingston County:

- Portage River (mi 84.56) – several state listed mussel species as well as federally endangered Snuffbox mussel in this area. HDD crossing appropriate with extra care to protect against slurry release.

- *Honey Creek (mi 86.8) – two state listed mussels historically found here included Slippershell (1929) and Wavyrayed lampmussel (1931). Also endangered fish species the Southern Redbelly Dace (1977). Mussel survey.

Rover Pipeline LLC's (Rover) Response:

The data sheets for all streams are included in the Delineation Reports for February 2015, June 2015, and April 2016. These forms are on MIWaters under Part 1C and labeled Delineation Reports.

All streams in Michigan were reviewed for potential presence of federally listed species, including consultations with the U.S. Fish and Wildlife Service, Michigan Natural Heritage, and Lori Sargent regarding federal and state listed species documented as occurring along the project alignment. As a result of this review, mussel surveys were conducted in Iron Creek in 2015 (survey report attached). No state or federally listed or special concern species were found in Iron Creek. No mussel surveys were conducted in the Raisin or Portage Rivers as the pipeline will be installed using HDD.

To address Mr. Jeffrey Braunscheidel's concerns, Rover agrees to conduct mussel surveys this year at the South Branch River Raisin (MP 39.76), Wolf Creek crossings (MPs 42.79, 43.75, and 4.52), Black Creek (MP 44.95), and Honey Creek (MP 86.8), and will consult with Mr. Braunscheidel regarding the type of surveys that may be needed at Bear Creek (MP 34.3), Mill Creek (MP 72.19), and North Fork Mill Creek (MP 73.93).

Part I Supplement, Appendix B, of Rover's application includes construction plans and procedures that will be implemented during construction and restoration of the project (see MIWaters). Specifically, with respect to stream crossings, are Appendix B2 (Wetland and Waterbody Construction and Mitigation Procedures), Appendix B3 (Spill Prevention and Response Procedures), and Appendix B4 (Horizontal Directional Drill Contingency Plan).

Also attached are copies of the 2015 habitat survey reports completed for the eastern massasauga rattlesnake in the vicinity of the Washtenaw/Livingston county line. Additional presence-absence surveys for the massasauga are underway now with the findings report due in fall 2016. Mist net surveys for Indiana and northern long-eared bat were also conducted in 2015 in Michigan. A total of 1510 bats, representing seven species, were captured at 435 sites along the project alignment, of which 91 were Northern long-eared bats. No Indiana bats were captured. That survey report is a large report and can be provided upon request. Rover is in continuing consultation with the U.S. Fish and Wildlife Service as part of the Federal Energy Regulatory Commission review of the overall project.

TRC COMPANIES, INC.
ROVER PIPELINE PROJECT

MUSSEL SURVEY

Prepared for:

TRC Companies, Inc.
650 Suffolk St
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Prepared by:

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ECT Project No: 150553

September 10, 2015

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1.0 Introduction

Rover Pipeline, LLC (Rover) is proposing to construct the Rover Pipeline (Project) that will cross surface waters in Michigan. As a part of this project, the U. S. Fish and Wildlife Service (USFWS) and Michigan Department of Natural Resources have requested that the Iron Creek crossing near Manchester, MI be surveyed by qualified aquatic ecologists to determine the presence or absence of federal and/or state listed threatened, endangered, and protected mussels. Environmental Consulting & Technology, Inc. (ECT) was hired by TRC Companies, Inc. (TRC) to conduct the mussel survey. This report outlines ECT's methods and survey results.

The mussel surveys were conducted in accordance with all applicable federal and state specific mussel survey protocols. The ECT project team conducted the mussel survey at and in the vicinity of the Iron Creek crossing. Mussels, both live and dead shells, were located, identified to the species, and enumerated. Because no live or dead federally or state listed species were observed, adverse effects as a result of the Project are not anticipated.

Preliminary research into the area consisted of a Michigan Natural Features Inventory (MNFI) query for state and federally listed species. While no information was readily available for the specific location of the crossing, a list of three species were identified in the Iron Creek subwatershed of the Raisin River watershed (MNFI HUC ID:4100002010070). The three species are described below.

***Alasmidonta viridis* [Slippershell][1]**
Federal Status: none
State Status: Threatened (legally protected)
Occurrences: Washtenaw County - 18 in 2010

Key Characteristics

The slippershell is a small (to 1.5 inches) mussel with a straight ventral margin. Beak sculpture has three to four ridges or loops. The lateral teeth are irregular and poorly developed; whereas the cardinal teeth are triangular with one in the right valve and two in the left valve. The shell is yellowish-brown and marked with fine green rays with a square posterior end and a rounded anterior end. The nacre is white and often iridescent towards the posterior end of the shell.

Habitat Needs

The slippershell typically occurs in creeks and headwaters of rivers in sand or gravel substrates. Occasionally, they occur in larger rivers and lakes and in mud substrates.

Management

The slippershell requires clear, clean water and substrates for survival. Like other mussels, threats include: siltation, poor water quality, point and non-point source pollution, and alteration of natural flow regimes. Maintenance or establishment of vegetated riparian buffers can help protect mussel habitats from these threats. Additionally, zebra mussels and other exotic species are a major threat to all mussels. Hence, control and management of exotic species also help protect native mussel species. And as with all mussels, protection of their hosts habitat is also crucial.

***Lampsilis fasciola* [Wavyrayed lampmussel][1]**

Federal Status: none

State Status: Threatened (legally protected)

Occurrences: Washtenaw County - 13 in 2010

Key Characteristics

The wavy-rayed lampmussel is a medium sized (to 3.5 inches) mussel with a moderately thick, rounded to ovate shell. The beak is slightly elevated above the hinge line and the beak sculpture consists of 3 to 5 indistinct wavy ridges. The shell is compressed to inflated (females) in shape and the anterior end is rounded with the posterior end bluntly pointed in males and rounded in females. The shell color ranges from yellow to yellowish green with numerous thin wavy green rays. The nacre is white and often iridescent posteriorly.

Habitat Needs

The wavy-rayed lampmussel occurs in small-medium sized shallow streams, in and near riffles, with good current. It rarely occurs in medium rivers. The substrate preference is sand and/or gravel.

Management

Like other mussels, threats to the wavy-rayed lampmussel include: natural flow alterations, siltation, channel disturbance, point and non-point source pollution, and exotic species. Maintenance or establishment of vegetated riparian buffers can help protect mussel habitats from

many of their threats. Control of zebra mussels is critical to preserving native mussels. Smallmouth bass are hosts to this species and so must be considered when managing for the wavy-rayed lampmussel.

***Pleurobema sintoxia* [Round pigtoe][1]**
Federal Status: none
State Status: SC – Speciel concern (rare or uncertain, not legally protected)
Occurrences: Washtenaw County – 6 in 2010

Key Characteristics

The round pigtoe is a relatively large (to 4 inches) mussel with a moderately thick, round shell and a rounded anterior end and a rounded or bluntly pointed posterior end. The beak is low and only slightly elevated above the hinge line. This species has a shallow beak cavity and beak sculpture consisting of 2 to 3 elevated ridges. The lateral teeth are straight and cardinal teeth are well developed with 2 in the left valve and 1 in the right valve. The shell is smooth and brown with faint green rays visible near the beak. The nacre is variable in color, from white to pink to rose colored.

Habitat Needs

The round pigtoe occurs in mud, sand, or gravel substrates of medium to large rivers.

Management

Like other mussels, threats to the round pigtoe include: natural flow alterations, siltation, channel disturbance, point and non-point source pollution, and exotic species. Maintenance or establishment of vegetated riparian buffers can help protect mussel habitats from many of their threats. Control of zebra mussels is critical to preserving native mussels. And as with all mussels, protection of their hosts habitat is also crucial.

2.0 Methods

On August 12, 2015, an approximate 50 m (160 ft) stretch of Iron Creek was visually surveyed for all mussel species. The central coordinates of the mussel survey were 42.095233° -84.025224°. The survey site included the pipeline workspace (~27 m/90 ft) and 10 m (~35 ft) upstream and downstream of the workspace (i.e., buffer zones; Figure 1). The total area surveyed was approximately 220 m^2 (~2370 ft^2) of Iron Creek.

Water clarity was excellent with visibility to the bottom throughout the entire survey area. Depths did not exceed 1.5 feet with average depths less than a foot. Substrates through the 50 m stretch were mostly small gravels and silty sand. Woody debris was present throughout the stretch, varying from small woody debris to large felled trees that crossed the width of the stream.

The survey protocols described were adapted from the Ohio Mussel Survey Protocol (April 2015)[1]. Two qualified aquatic ecologists used glass-bottom buckets to search substrates for live mussels and dead shells. The survey was conducted in the downstream direction and covered bank to bank. When a mussel or shell was found, a pink marking flag was inserted into the substrate next to the mussel for later recording and identification. The survey continued until the downstream terminal of the survey area was reached. When all observed mussels were marked with the flags, GPS polygons were recorded around each grouping of mussels. Single mussels were marked with a single GPS point, and smaller groups (<5) had a central point marked and the number within a one meter radius were recorded. For each GPS grouping, stream features (e.g., riffle, run, pool) and dominate substrates were recorded.

Live mussels or shells were identified to the species level. Dead shells were returned to the stream and live mussels were returned to the same location and orientation in the substrates as when collected. Mussel fragments and shells that were long dead and weathered were not identified due to degradation of identifying features.

[1] Ohio Department of Natural Resources (ODNR), Division of Wildlife and U.S. Fish and Wildlife Service (USFWS), Ohio Ecological Services Field Office

3.0 Results

There were five distinct groups of mussels found during the survey, and two smaller locations with less than 3 mussels each. One location had a single mussel and the other had three within a one meter radius (Figure 2). Throughout the survey area, only six live mussels of two different species and 72 whole shells or half shells from four species were recorded (Table 1). There was also an abundance of dead fingernail clam shells throughout the survey area; however, these were only observed and not recorded. Among all of the identified species (dead or alive), none were state or federally threatened, endangered, or special concern species. The following is a description of all mussel groupings and the results of the mussel IDs. The descriptions are listed from the upstream buffer zone and continuing downstream through the downstream buffer zone.

Table 1 - Mussels identified during the survey of the pipeline crossing at Iron Creek near Manchester, MI on August 12, 2015. Species results are dead specimens (i.e., shells only) unless followed by 'live' in parentheses.

Group	Scientific name	Common name	No.
Mussel group 1	*Elliptio dilatata*	Spike	12
Mussel group 2	*Lampsilis ovata*	Pocketbook	2
	Elliptio dilatata	Spike	4
	Fusconaia flava	Wabash pigtoe	1
Single mussel	*Elliptio dilatata*	Spike	1
Centroid	*Elliptio dilatata*	Spike (live)	1
		Spike	2
Mussel group 3	*Lampsilis siliquoidea*	Fatmucket (live)	1
	Elliptio dilatata	Spike	21
		Spike (live)	4
	Fusconaia flava	Wabash pigtoe	1
Mussel group 4	*Elliptio dilatata*	Spike	15
	Fusconaia flava	Wabash pigtoe	1
Mussel group 5	*Elliptio dilatata*	Spike	9
	Fusconaia flava	Wabash pigote	3

Mussel Group 1

The first mussel group was mostly contained within the upstream buffer zone (Figure 1). The area of this grouping was approximately 180 ft^2. The stream feature it encompassed was mostly riffle habitat, and the substrates were small gravels on top of sand. Twelve mussel shells or half shells were found in this group and no live mussels. All shells were of the species *Elliptio dilatata*, commonly referred to as Spike.

Mussel Group 2

The second mussel group began near the western edge of the pipeline workspace (Figure 1). The area of this grouping was approximately 195 ft^2. It consisted of pool habitat through a northward bend in the stream. The substrates were mostly soft (i.e., silt and some sand) with small gravels mixed in. Seven mussel shells were found in this group that consisted of three different species: Spike *Elliptio dilatata*, Pocketbook *Lampsilis ovata*, and Wabash Pigtoe *Fusconaia flava*. No live mussels were observed in this mussel group.

Single and Centroid Group

A single Spike mussel shell was observed just downstream of mussel group 2 in similar substrates (Figure 1). Downstream of this shell was a small group of three mussels within an approximate one meter radius (Figure 1). The substrates were a mix and sand and small gravels. Within this small grouping were two Spike shells and one live Spike.

Mussel Group 3

The third group was located through a riffle, with small gravels on top of silt and sand substrates (Figure 1). The area of this grouping was approximately 200 ft^2. This group also contained the largest number of observed shells and live mussels. The majority of shells were Spike (21). One Wabash Pigtoe shell was also observed. Five live mussels were observed in this group. Four were Spike and one was a Fatmucket *Lampsilis siliquoidea*.

Mussel Group 4

The fourth mussel group was located through a riffle/run feature and ended near the eastern edge of the pipeline workspace (Figure 1). The area of this grouping was approximately 161 ft^2. The left half of the stream (as observed looking downstream) contained small gravel substrates, while the right half of the stream was mostly silty sand substrates. This group contained the second highest number of shells, most of which were Spike (15). One Wabash Pigtoe shell was observed in this group. No live mussels were observed within this group.

Mussel Group 5

The fifth mussel group was located mostly within the downstream buffer zone within run habitat (Figure 1). The area of this grouping was approximately 59 ft^2. The upper half of the group along the middle-left bank contained small gravel substrates while the right bank was mostly sand/silt. The lower half of the group was mostly silt and sand mixed with small gravel substrates. This group contained nine Spike shells and three Wabash Pigtoe shells. No live mussels were observed in this reach.

Figure 1 - Location of the mussel survey conducted on August 12, 2015.

4.0 Discussion

No live mussels were observed within the upstream or downstream buffer zones. Within the pipeline workspace, six live mussels were observed. Both species of live mussels observed in the pipeline workspace are common in Michigan streams. None of the species observed during the survey are state or federally listed as endangered, threatened, or special concern species. Due to the proximity of the stream to agricultural activities, it is possible this section of the stream experiences increased sedimentation and organic pollution (e.g., excess nutrients). These can have negative impacts on mussel populations. Due to the absence of federal or state listed species, as well as the low number of live mussels, adverse impacts are not expected as a result of the Project.

Final Report: Eastern Massasauga (*Sistrurus catenatus*) Habitat Assessment along the Rover Pipeline Project in Washtenaw and Livingston Counties, Michigan

Submitted to:

TRC Environmental, Inc.

Submitted by: Jeffrey G. Davis, Ohio Division of Wildlife Approved Herpetologist

September 24, 2015

1.0 INTRODUCTION

1.1 Purpose

Habitat Assessments were conducted for the Eastern Massasauga (*Sistrurus catenatus;* Figure 1) along the Rover pipeline project ROW in Washtenaw and Livingston counties in Michigan (Figure 2). Upon completion of a desktop survey, seven segments of the pipeline right of way (ROW), some comprising multiple tracts, required site visits to further assess their suitability as Massasauga habitat. The outcome of the desktop survey and site visits determined whether or not a Presence-Absence Survey would be recommended at any of the sites. Recommendations are presented in Section 4.0.

1.2 Site Descriptions

The seven sites that were visited September 14 and 15, 2015 are described below. The results of the Habitat Assessment for each is reported in Sections 3.4.1 through 3.4.7.

1.2.1 Tract MI-WA-120.000 (Figure 3; approximate mile posts 83.90 to 84.00; 42.41590°N, -83.95114°W to 42.415686°N, -83.95117°W) is located in Washtenaw County east of Dexter Townhall Road. The pipeline ROW extends through an upland field dominated by grasses and forbs (Figure 4). A wetland with an open canopy is located less than 75 meters east of the ROW and provides potential overwintering habitat. The ROW extends through a wetland area to the south. Much of it is under a closed canopy.

1.2.2 Tract MI-WA-121.000 (Figure 3; approximate mile posts 84.10 to 84.25; 42.41797°N, -83.95043°W to 42.41930°N, -83.95036°W). This segment of the pipeline is located in Washtenaw County, east of Silver Lake and Dexter Townhall Road at the Post 46 Hunting and Fishing Club. The pipeline ROW extends along the margin of a woodlot and open field, much of which is mowed to within 2 inches of the ground. Unmowed areas are dominated by grasses and forbs. The soils at this site have been moved and are very disturbed (Figure 5).

1.2.3 Tracts MI-LI-004.000 and MI-LI-004.570 (Figure 6; approximate mile posts 85.2 to 85.25; 42.43194°N, -83.95666°W to 42.43758°N, -83.95818°W). This extensive sedge meadow is located in Livingston County, south of Patterson Lake Road and east of Clydesdale Court in the Saddlebrook Subdivision. Several species of sedges, shrubby Dogwoods, Black Willows,

and Sensitive Ferns dominated the wetland (Figure 7). The pipeline ROW extends along the eastern margin of the wetland.

1.2.4 Tracts MI-LI-006.000, MI-LI-007.000, and MI-LI-007.500 (Figure 8; approximate mile posts 85.7 to 86.00; 42.43845°N, -83.95865°W to 42.44323°N, -83.95788°W). These tracts are in Livingston County and extend north from Patterson Lake Road. The southern two-thirds of this segment of pipeline ROW consists of a hay field which ends at approximately 42.44233°N, -83.95823°W. In recent years it was a pasture and was once planted in row crops. The ROW is located along the eastern half of the hay field. Immediately north of this point is an extensive wetland dominated by grasses, sedges, cattails, spotted Joe-Pye weed, and black willows (Figure 9). The ROW bends to the northeast and passes immediately east of the wetland through a mix of hardwood trees and wet meadow dominated by grasses and forbs (Figure 10). The ROW extends across a gravel access road at 42.44350°N, -83.95782°W. The wetland extends east of the gravel road but is choked with cattails.

1.2.5 Tracts MI-LI-009.510, MI-LI-010.500, and MI-LI-011.500 (Figure 11; approximate mile posts 86.30 to 86.40; 42.44745°N, -83.95586°W to 42.44889°N, -83.95592°W). This segment of the pipeline ROW is located in Livingston County. A small, triangular scrub-shrub wetland is located just west of the ROW near 42.44745°N, -83.95586°W. The ROW skirts the western edge of a woodlot through a dry upland field dominated by grasses and a variety of forbs.

1.2.6 Tracts MI-LI-019.000, MI-LI-020.000, MI-LI-021.000, MI-LI-021.500, MI-LI-021.510, MI-LI-022.000, MI-LI-022.500, MI-LI-022.510, and MI-LI-023.000 (Figure 12; approximate mile posts 87.10 to 87.85; 42.45727°N, -83.95837°W to 42.46425°N, -83.95949°W). A segment of the ROW, and a larger area extending south to 42.45559°N, -83.95889°W was added to this survey site to include the wetlands on the floodplain of Honey Creek (Figure 13) and the adjoining uplands (Figure 14). The ROW extends north across State Route 36, the Lakelands Trail State Park bicycle path, and beyond to the tree line at 42.46425°N, -83.95949°W. The field immediately south of State Route 36 is highly disturbed and is nearly 30 feet above the Honey Creek floodplain wetlands. The field north of State Route 36 and the Lakelands Trail State Park bicycle pate is planted in row crops (soybeans in 2015). The Honey

Creek floodplain wetlands were dominated by grasses, sedges, dogwood species, blue vervain, other wetland forbs, and cattails. The uplands, through which the ROW and the reroute extend are dominated by grasses, sedges, and dogwood species.

1.2.7 Tracts MI-LI-022.510 and MI-LI-022.520 (Figure 15) approximate mile posts 86.8 to 86.9; 42.46572°N, -83.95982°W to 42.46701°N, -83.95985°W. Located in Livingston County, this segment of the pipeline ROW had a few small patches of grasslands but was primarily dominated by patches of hardwoods and conifers planted in rows. No wetland was associated with it.

1.3 Eastern Massasauga Life History

The Eastern Massasauga, reaching a record length of 100.3 cm (39.5 inches), is the only rattlesnake species in Michigan. Most adult individuals however are approximately 45.7–55.9 cm (18–22 inches) in length. Massasaugas usually have brown or black blotches on a gray or tan background and white and brown stripes on the sides of their head. Some individuals are melanistic, a form which tends to be more common in northern populations.

Massasaugas are almost always associated with wet areas such as bogs, fens, swamps, or the edges of ponds and lakes. They overwinter in these wet areas, especially in crayfish or small mammal burrows. In Michigan they usually emerge from their hibernacula in April and remain in grass or sedge dominated habitats until early summer when they move to upland habitats dominated by grasses and prairie plants. It is not uncommon for them to move into hay fields during summer where their prey abounds. In some populations only gravid females may demonstrate the habitat change. Their upland habitats are almost always a mosaic of small, early successional woody species such as hawthorn (*Crataegus sp.*), dogwood (*Cornus sp.*), multiflora rose (*Rosa multiflora*) or raspberry (*Rubus sp*). Common herbaceous species associated with Massasaugas may include the sensitive fern (*Onoclea sensibilis*), goldenrod (*Solidago* sp.), partridge pea (*Cassia fasciculata*), cinquefoil (*Potentilla* sp.), strawberry (*Fragaria* sp.), and *Sphagnum*. This diversity of plant species indicates that the Massasauga can be found in a variety of habitats. It has been suggested that its diet in the spring contains frogs and then switches to small mammals and birds as it moves into the higher, drier habitats during summer. Telemetric studies indicate that males and non-pregnant females may range 200–1,300

meters (650–4,265 feet) from their winter hibernacula. Pregnant females may move 300–600 meters (984–1968.5 feet). Massasaugas return to their hibernacula by late summer and in Michigan have been observed around their burrows as late as October 30 as long as the temperature remains above 50°F.

Sexual maturity among Massasaugas is believed to be reached at 3–4 years depending upon food availability, length of their activity period, and availability of suitable basking sites. In Michigan they mate in spring and again in later summer or early fall. Offspring resulting from fall matings are born in spring. If mating occurs during spring, neonates are generally born in mid-August but parturition has been observed as late as October 10. Litters consist of 3–19 neonates and they are born close to the mother's hibernaculum. Across their range Massasaugas may reproduce annually or biannually. In captivity the species may live over 20 years and in the wild from 8–10 years.

Massasauga populations have been declining in Michigan and other Great Lakes states. While it is listed as threatened or endangered by the states in most of its range, in Michigan it is listed as a Species of Special Concern. As a result of significant decline over much of its range, the U.S. Fish and Wildlife Service listed it as a candidate species in 1998.

2.0 METHODS

The procedure utilized in this Habitat Assessment was that which is recommended by the Ohio Division of Wildlife and the U.S. Fish and Wildlife Service.

2.1 Site Visits

A pedestrian survey was conducted at the subject site on September 14 and 15, 2015 to look for and evaluate six primary indicators of Eastern Massasauga habitat. These included (1) the presence of crayfish or small mammal burrows (hibernacula); (2) upland habitat dominated by grasses and forbs with small shrubby plants (ex. dogwoods, cinquefoil, hawthorns) (3) evidence of mice and other small mammals (burrows, middens, nests, or habitat suitable for them); (4) open canopy basking sites; (5) a water table close to the soil surface; and (6) a vegetative assemblage typical of Eastern Massasauga habitat. Access was only available to the pipeline

ROW. Habitat outside the ROW was evaluated from roads and other access points through binoculars and on aerial photographs.

2.2 Museum and Literature Searches

A seventh indicator used in the evaluation of the habitat is the historical distribution of Eastern Massasaugas in the vicinity of the subject site/s. This is accomplished by a review of the literature and a search for museum specimens. Soil maps were also reviewed to determine if the soils in the vicinity of each site are similar in composition (muck or clay) to those in which Eastern Massasaugas are known to inhabit, especially as overwintering habitat (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

2.3 Habitat Quality Ranking

The results of the site visits were combined with the literature and museum searches to assess the suitability of the proposed project areas as Eastern Massasauga habitat. Where potential habitat (habitat ranked as moderate or high quality) was determined to be present at the site, a Presence-Absence Survey is recommended.

Eastern Massasauga habitat quality is ranked by the number of habitat indicators present at the subject site and the history of known populations in its vicinity. Finally, **if no museum or literature records for Massasaugas exist** near the subject site, consideration is given based on what is known about the herpetological community in the respective county. If herpetologists have documented a significant portion of the species whose range includes the proposed project area, and the Eastern Massasauga is not among them, one can infer that the species does not occur there. If, however, few of the expected species have been documented, the Eastern Massasauga might be among those that have gone undetected.

The habitat is determined to be of **high quality** if all indicators are present during a Habitat Assessment. Five or six indicators rank the habitat to be of **moderate quality**, and four or less indicators rank the habitat as **low quality** for the Eastern Massasauga. If a major component of the habitat is lacking, despite a habitat rank that warrants a Presence-Absence Survey, a decision may be made not to do the survey. Most often, this results from a lack of hibernacula or in areas where habitats have been drained or otherwise altered.

3.0 RESULTS

3.1 Museum Search

Livingston and Washtenaw counties have long histories of Eastern Massasauga documentation. The museum search provided 40 historical records for the Eastern Massasauga from Livingston County, 28 of which are from the University of Michigan Museum of Zoology (UMMZ) and 12 are from the American Museum of Natural History in New York City. The most recent of these records (UMMZ 241822) was collected in 2010. The earliest Livingston County record was collected in 1917. Washtenaw County was also represented by 40 Eastern Massasauga records in museum collections. Two were from the United States National Museum (Smithsonian) in Washington D.C. and 38 were in the collections at the University of Michigan Museum of Zoology. The most recent Washtenaw County record (UMMZ 241995) was collected in 2012 and the earliest record collected dates back to 1868.

3.2 Literature Search

Holman (2012) discussed the Eastern Massasaugas as being widely distributed in the northern and southern thirds of the Lower Peninsula and included records from both Livingston and Washtenaw counties in his dot distribution map for the species. Holman also reported the species from every county bordering Livingston and Washtenaw counties with the exception of Monroe County, southeast of Washtenaw County on the Ohio border. Szymanski (1998) reported 13 Livingston County Eastern Massasauga sites, most of which were extant during the 1980s and 1990s. She listed 11 sites from Washtenaw County with records from as recent as the 1970s through the 1990s. More recently, on September 17, 2015, a woman was bitten by a Massasauga in Washtenaw County at the Matthaei Botanical Gardens in Ann Arbor (**http://www.detroitnews.com/story/news/local/michigan/2015/09/15/woman-bit-rattle snake-ann-arbor-botanical-garden/72309252/).**

3.3 Soil Map Review

A review of soil maps revealed muck soils (Carlisle, Tawas, or Houghton muck) at four of the seven sites visited on September 14 and 15, 2015 (soil maps were accessed from **http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx**). Muck soils are hydric, present at most known Massasauga sites, and inhabited by chimney building crayfish species whose

burrows most often serve as Eastern Massasauga hibernacula. The four sites at which muck soils were present were on (1) Tract MI-WA-120.000, (2) Tracts MI-LI-004.000 and MI-LI-004.570, (3) Tracts MI-LI-007.000 and MI-LI-007.500, and (4) Tract MI-LI-019.000 (Figures 16 – 19).

3.4 Site Visit (Pedestrian Survey) Results

3.4.1 The owner of Tract MI-WA-120.000 (see Figure 3) reported seeing Massasaugas at this site in recent years. A Star-nosed Mole (*Condylura cristata*) was observed during the site visit and photographed. Star-nosed Moles inhabit swamps, bogs, and low, wet meadows (Burt, 1972). Such habitats are nearly identical to those of Eastern Massasaugas. Although never reported in the Massasauga's diet, this small mammal is closely related to the Short-tailed Shrew (*Blarina brevicauda*) which is frequently preyed upon by Massasaugas. The potential overwintering habitat was not on the ROW and therefore could not be searched for crayfish burrows but they were abundant in mowed lawns along Dexter Townhall Road. **A Presence-Absence Survey is recommended for this site. Extending the Presence-Absence survey south to 42.41528°N, -83.95122°W is also recommended.**

Presence of Crayfish Burrows	Upland Habitat Present	Water Table Close to Surface (Wetlands)	Evidence of or Habitat Suitable for Small Mammals	Basking Sites Available (Open Canopy)	Vegetation Assemblage Characteristic of Massasauga Habitat	Historical Massasauga Records Within County	**Total**
✔	✔	✔	✔	✔	✔	✔	7 of 7

3.4.2 The Post 46 Hunting and Fishing Club is located on Tract MI-WA-121.000 (see Figure 3). Its proximity to Tract MI-WA-120.000 made it an area of interest upon completion of the desktop survey. However, the site is highly disturbed. The soils have been scraped and pushed into piles to serve as back drops to stop bullets behind targets on gun ranges. The grass over much of the site is mowed to only an inch or two, a practice that is often used to keep Massasaugas out of an area. The nearest wetland was under the canopy of a woodlot. **No further consideration regarding Eastern Massasaugas at this site is necessary.**

Presence of Crayfish Burrows	Upland Habitat Present	Water Table Close to Surface (Wetlands)	Evidence of or Habitat Suitable for Small Mammals	Basking Sites Available (Open Canopy)	Vegetation Assemblage Characteristic of Massasauga Habitat	Historical Massasauga Records Within County	**Total**
No	✔	No	✔	✔	No	✔	4 of 7

3.4.3 During the pedestrian survey through Tracts MI-LI-004.000 and Mi-LI-004.570 (see Figure 6) crayfish burrows were found, and Northern Leopard Frogs (*Lithobates pipiens*) and an Eastern Gartersnake (*Thamnophis sirtalis*), both of which are species included in the diet of juvenile Massasaugas, were observed. Small mammals, which appeared to be meadow voles (*Microtis pennsylvanicus*) were observed twice along a chain-link fence in the sedge meadow. During a Land Owners' Meeting, Nick Zlojutro, a Land Agent working on the project, was told by residents of three different sightings of Massasaugas on the west side of the Saddlebrook subdivision during 2015. The pipeline ROW is east of the subdivision, but the habitat on the east side, based on aerial photographs and soil survey results, appears superior to the habitat west of it. A pedestrian survey was not conducted west of the subdivision. **A Presence-Absence Survey is recommended for this site between 42.43360°N, -83.95629°W and 42.43172°N, -83.95629°W.**

Presence of Crayfish Burrows	Upland Habitat Present	Water Table Close to Surface (Wetlands)	Evidence of or Habitat Suitable for Small Mammals	Basking Sites Available (Open Canopy)	Vegetation Assemblage Characteristic of Massasauga Habitat	Historical Massasauga Records Within County	**Total**
✔	✔	✔	✔	✔	✔	✔	7 of 7

3.4.4 The pipeline segment extending through Tracts MI-LI-006.000, MI-LI-007.000, and MI-LI-007.500 begins on the north side of Patterson Lake Road (see Figure 8). The southern portion of it has a land use history that includes row crops and a pasture for a bison farm. For the past several years it has been a hay field planted in Timothy Grass and Alfalfa. The northern half of this field begins to slope downward toward a large wetland. In September of 2014, the land owner observed two Eastern Massasaugas at the ecotone between the hay field and wetland. He also reported a high population density of mice that "hopped on their hind legs" that could be seen as he cut the hay field in early September 2015. The Meadow Jumping Mouse (*Zapus hudsonius*) is the only mouse in the region that moves bipedally as described by the land owner. This small rodent is known to be preyed upon by Massasaugas. A Thirteen-lined Ground Squirrel (*Spermophilus tridecimlineatus*) was observed on the pipeline ROW near the north end of the hay field during the site visit. This species is small enough to be preyed upon by adult Massasaugas. Crayfish burrows were observed in the wetland. The pipeline ROW bends northeast along the eastern margin of the wetland and continues to a gravel access road located at

42.44323°N, -83.95788°W (see Figure 8). Southwest of the gravel road, it extends through an open patchwork of hardwood trees, grasses, and forbs (see Figure 10) and is adjacent to the aforementioned wetland. As the ROW continues northeast across the gravel road there is a wetland that is choked with cattails and is unsuitable for Massasaugas. **A Presence-Absence Survey is recommended from the northern third of the hay field (approximately 42.44125°N, -83.95817°W; see the pink line in Figure 8) to the gravel access road at 42.44323°N, -83.95788°W.**

Presence of Crayfish Burrows	Upland Habitat Present	Water Table Close to Surface (Wetlands)	Evidence of or Habitat Suitable for Small Mammals	Basking Sites Available (Open Canopy)	Vegetation Assemblage Characteristic of Massasauga Habitat	Historical Massasauga Records Within County	**Total**
✔	✔	✔	✔	✔	✔	✔	7 of 7

***applies only to between 42.44125°N, -83.95817°W and 42.44323°N, -83.95788°W.**

3.4.5 Tracts MI-LI-009.510, MI-LI-010.500, and MI-LI-011.500 were very dry at the time of the site visit on September 14, 2015. The small, triangular wetland located at the western edge of the pipeline ROW at approximately 42.44745°N, -83.95586°W, a scrub-shrub wetland (see Figure 11), showed no evidence of crayfish burrows on the date of the site visit, a time at which Massasaugas are moving to their overwintering habitat. Another wetland, about 20 feet lower in elevation and west of the pipeline ROW appears to have been altered to form a pond. The field in which the ROW is located looks to be an old pasture that is undergoing successional changes. Those changes and its location at an elevation well above the wetland make this site unsuitable for Massasaugas. **No further consideration regarding Eastern Massasaugas at this site is necessary.**

Presence of Crayfish Burrows	Upland Habitat Present	Water Table Close to Surface (Wetlands)	Evidence of or Habitat Suitable for Small Mammals	Basking Sites Available (Open Canopy)	Vegetation Assemblage Characteristic of Massasauga Habitat	Historical Massasauga Records Within County	**Total**
no	✔	no	✔	✔	✔	✔	5 of 7

***lack of potential overwintering habitat negates the score of 5 of 7 indicators.**

3.4.6 Tracts MI-LI-019.000, MI-LI-020.000, MI-LI-021.000, MI-LI-021.500, MI-LI-021.510, MI-LI-022.000, MI-LI-022.500, MI-LI-022.510, and MI-LI-023.000 extend north from the

Honey Creek valley (see Figure 12). The floodplain wetlands on the south and north side of Honey Creek provide potential overwintering habitat and the adjacent wetlands, especially on the south side of Honey Creek, provide potential upland habitat. **A Presence-Absence Survey is recommended in the floodplain wetlands (Tract MI-LI-019.00) and adjacent upland habitat on both sides of Honey Creek.** The valley wall rises sharply on the north side of the creek at the pipeline ROW. The upland habitat at, and north of, the valley wall all the way to the row cropped field north of the Lakelands Trail bicycle trail (inclusive) are too disturbed and high above the floodplain wetlands to provide suitable Massasauga habitat. **No further consideration regarding Eastern Massasaugas north of the Honey Creek valley wall is necessary.**

Presence of Crayfish Burrows	Upland Habitat Present	Water Table Close to Surface (Wetlands)	Evidence of or Habitat Suitable for Small Mammals	Basking Sites Available (Open Canopy)	Vegetation Assemblage Characteristic of Massasauga Habitat	Historical Massasauga Records Within County	**Total**
no	✔	✔	✔	✔	✔	✔	6 of 7

*applies only to wetlands and adjacent uplands between 42.45559°N, -83.95889°W & 42.45727°N, -83.95837°W.

3.4.7 Tracts MI-LI-022.510 and MI-LI-022.520 (see Figure 15) were the northernmost tracts surveyed. There is no potential overwintering habitat, and much of the area is under the canopy of conifers planted in rows. **No further consideration regarding Eastern Massasaugas at this site is necessary.**

Presence of Crayfish Burrows	Upland Habitat Present	Water Table Close to Surface (Wetlands)	Evidence of or Habitat Suitable for Small Mammals	Basking Sites Available (Open Canopy)	Vegetation Assemblage Characteristic of Massasauga Habitat	Historical Massasauga Records Within County	**Total**
no	✔	no	✔	✔	no	✔	4 of 7

4.0 Recommendations

Based on evidence presented in Sections 3.4.1, 3.4.3, 3.4.4, and 3.4.6 above, Eastern Massasauga Presence-Absence Surveys are recommended for (1) Tract MI-WA-120.000, (2) Tracts MI-LI-004.000 and MI-LI-004.570, (3) Tract MI-LI-019.000, and (4) Tracts MI-LI-006.000, MI-LI-007.000, respectively. Tract MI-LI-019.000 in the Honey Creek floodplain had six of the seven indicators evaluated for during Habitat Assessments. Crayfish burrows were not observed, but crayfish are likely present at the site. Water depth in Honey Creek prohibited

actually walking into the wetland. Six of seven indicators suggests moderate quality Massasauga habitat. All seven indicators were observed at the other tracts suggesting they provide high quality Massasauga habitat.

Presence-Absence Surveys must not just consider the pipeline ROW but also appropriate upland and overwintering habitat on either side of it. Massasaugas may move several hundred meters over the course of a year and during their migrations between their hibernacula and upland (summer) habitats they could move across the ROW several times.

Literature Cited

Burt, W.H. 1972. Mammals of the Great Lakes Region. University of Michigan Press. Ann Arbor. 246 p.

Holman, J.A. 2012. The Amphibians and Reptiles of Michigan. Wayne State University Press. Detroit, Michigan. 291 p.

Szymanski, J. 1998. Status assessment for the Eastern Massasauga (*Sistrurus c. catenatus*) 1994. U.S. Fish and Wildlife Service, Endangered Species Division, Fort Snelling, Minnesota. 30 pp. + appendices.

Figures

Figure 1. An adult Eastern Massasauga (*Sistrurus catenatus*) from Greene County, Ohio.

Figure 2. Location of Washtenaw (W) and Livingston (L) counties in Michigan.

Figure 3. Tracts MI-WA-120.000 and MI-WA-121.000 are located in Washtenaw County east of Dexter Townhall Road and Silver Lake. Potential upland and hibernation habitat was identified at MI-WA-120.000. MI-WA-121.000 was highly disturbed.

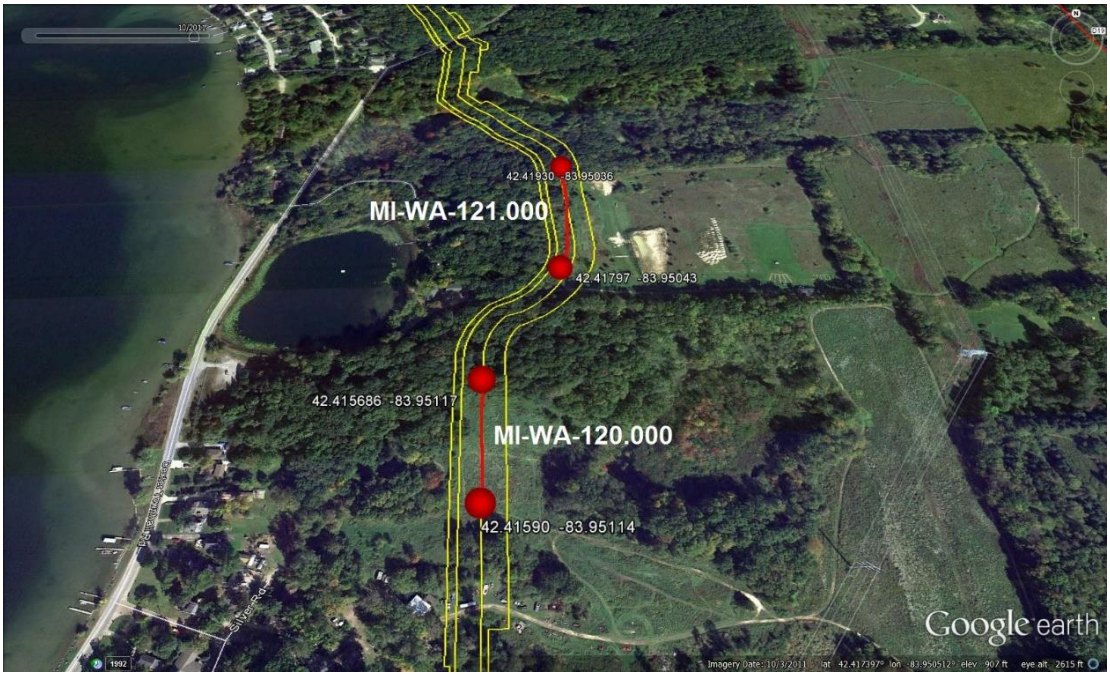

Figure 4. The dominant vegetation at Tract MI-WA-120.000 consists of grasses and forbs such as goldenrods.

Figure 5. The pipeline ROW extends along the western margin of this field at the Post 46 Hunting and Fishing Club. The soils at this site have been pushed into piles on the gun ranges. Much of it is mowed to only a couple of inches making unfavorable for Eastern Massasaugas.

Figure 6. The pipeline ROW extends along the eastern margin of this sedge meadow east of the Saddlebrook subdivision. Three Massasauga sightings on the western edge of the subdivision were reported by residents during 2015.

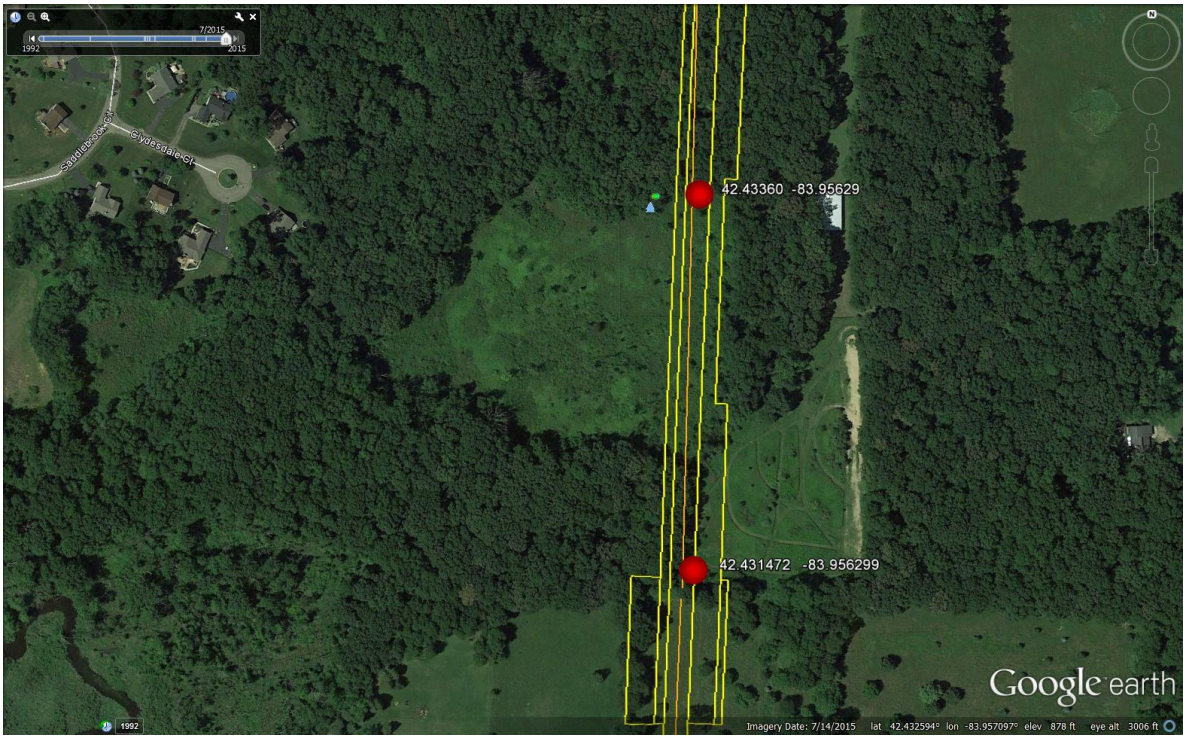

Figure 7. The vegetation in the sedge meadow is consistent with high quality Massasauga habitat. Crayfish burrows and prey species of Massasaugas were also observed.

Figure 8. This segment of the pipeline ROW extends through a hay field, from Patterson Lake Road north to a fence line (blue line), beyond which is an extensive wetland. The ROW continues northeast through a mosaic of open woods among a mix of grasses, goldenrods, and other forbs to a gravel access road at approximately 42.44323°N, -83.95788°W. Northeast of this point the wetland is a dense cattail marsh. During the summer when Massasaugas move into upland habitats, including hay fields, to feed on rodents it is conceivable that they might move up the slope in this field to the pink line.

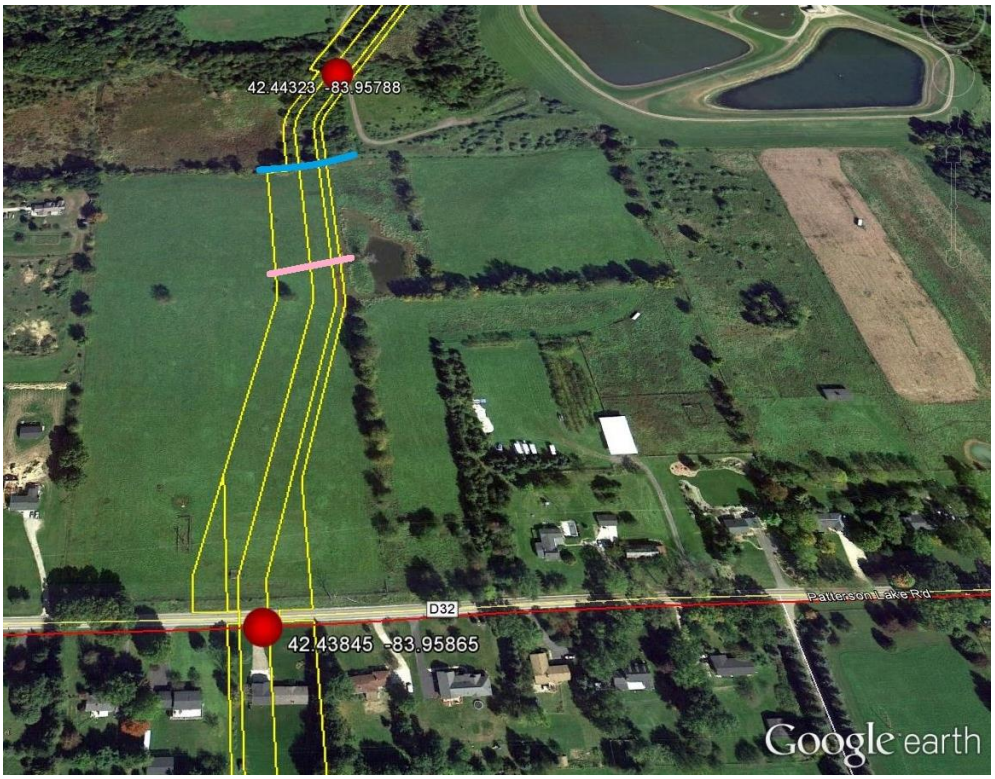

Figure 9. Wetland immediately north of the hay field (see Figure 8). This wetland is extensive and may provide overwintering habitat for Eastern Massasaugas.

Figure 10. Looking west from the gravel access road near the pipeline ROW at approximately 42.44323°N, -83.95788°W (see Figure 8). This segment of the pipeline ROW provides potential upland habitat for Eastern Massasaugas and the wetland behind the trees in this photo, which is contiguous with the wetland illustrated in Figure 9, provides potential overwintering habitat.

Figure 11. This segment of the pipeline ROW was very dry and undergoing successional changes. The small, triangular wetland near 42.44745°N, -83.95586°W is a shrub-scrub wetland that was very dry on September 14, 2015, the day of the site visit, a time period when Massasaugas should be returning to their overwintering sites. There was no sign of crayfish burrows at the wetland. The larger wetland to the west of the ROW has undergone modification and is situated a lower elevation.

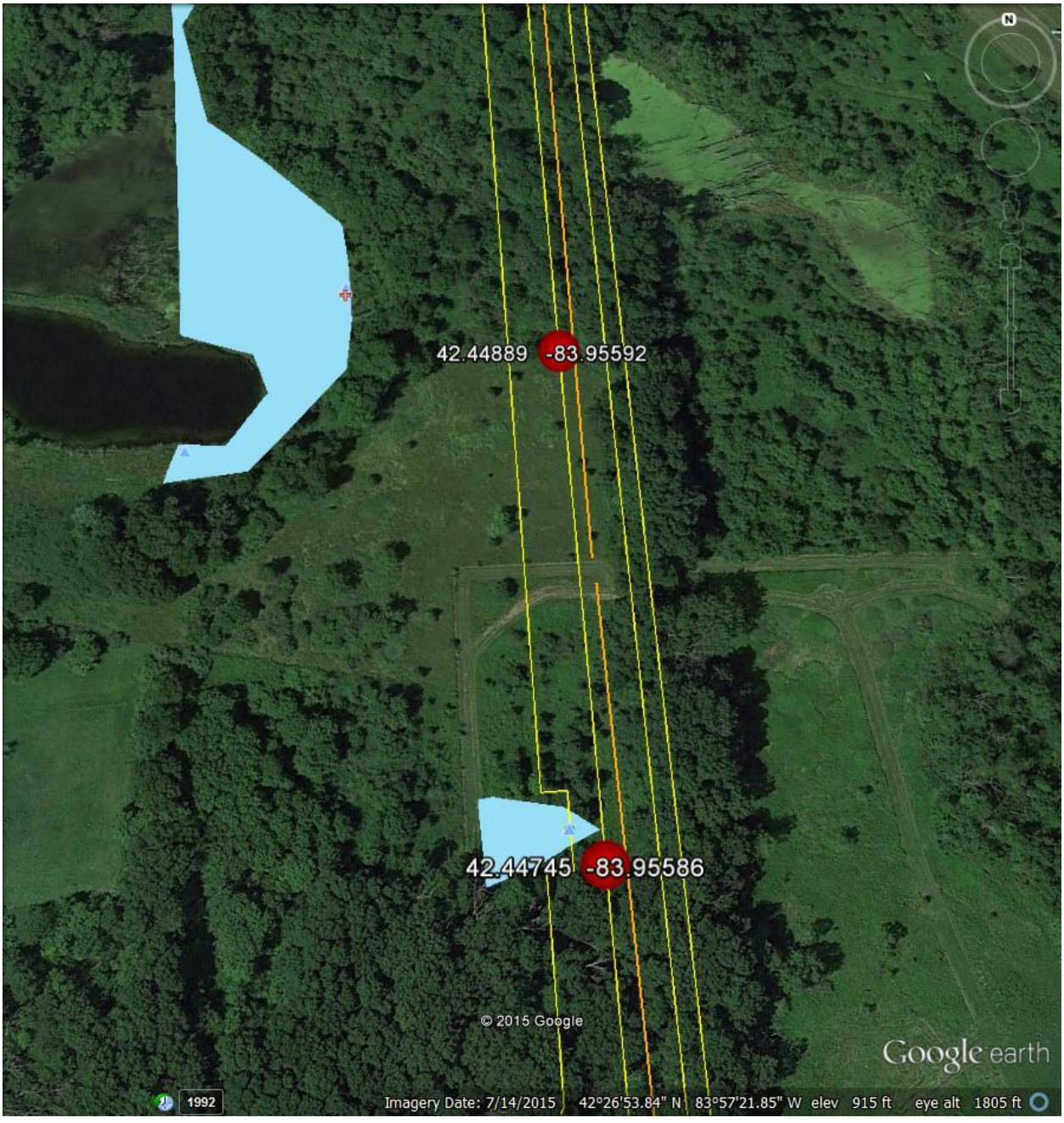

Figure 12. The Honey Creek valley in Tract MI-LI-019-000, provides potential Massasauga overwintering habitat and the adjacent uplands provide potential foraging habitat. The segments of the pipeline ROW north of 2.45727°N, -83.95837°W have been disturbed or are planted in row crops and do not provide potential Massasauga habitat.

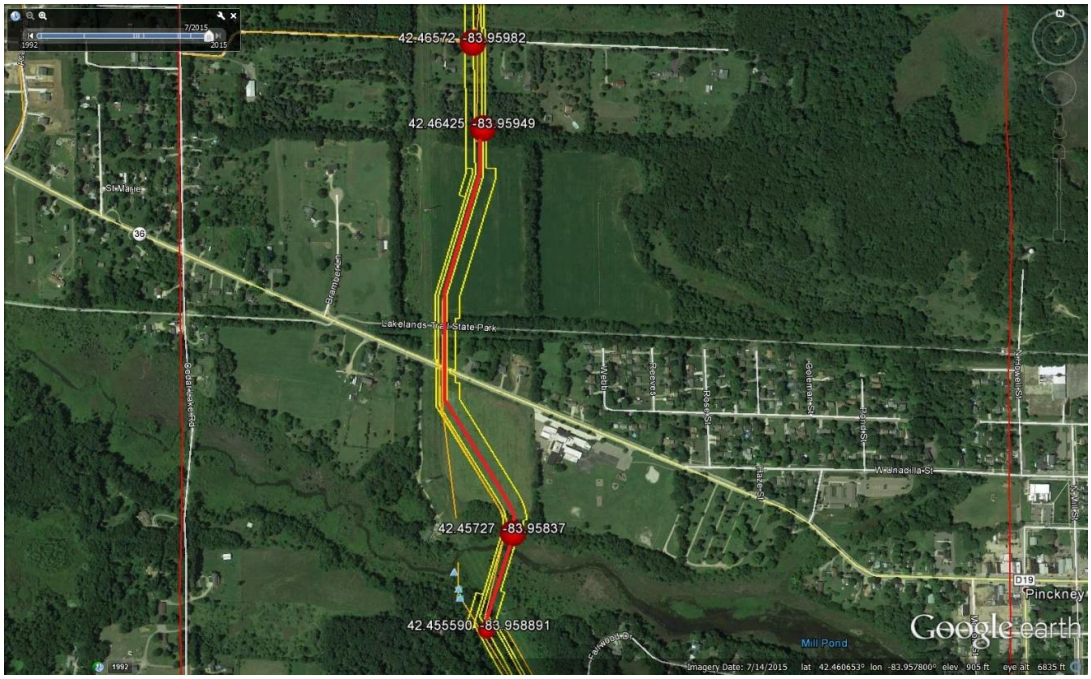

Figure 13. Wetland on the floodplain of Honey Creek (immediately east of Figure 14).

Figure 14. Upland habitat on the south side of Honey Creek (immediately west of Figure 13).

Figure 15. The pipeline ROW passes through the western margin of a field in Tracts MI-LI-022.510 and MI-LI-022.520. There was no evidence of a potential Massasauga hibernaculum at this site.

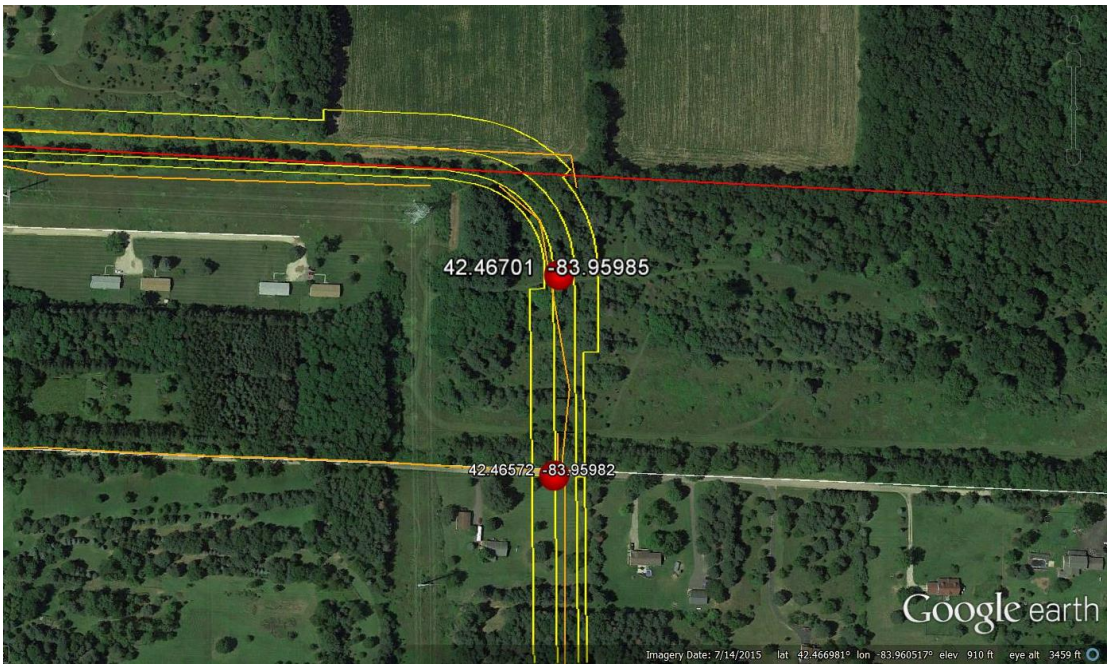

Figure 16. Soil map of Tract MI-WA-120.000. The wetland that provides potential habitat is underlain by Houghton Muck soil (Hn) and is situated east of the pipeline ROW (see also Figures 3 and 4).

Figure 17. Soil map of the sedge meadow east of the Saddlebrook subdivision is underlain by Carlisle muck soil (Cc). The pipeline ROW passes through the eastern edge of the sedge meadow (see also Figures 6 and 7).

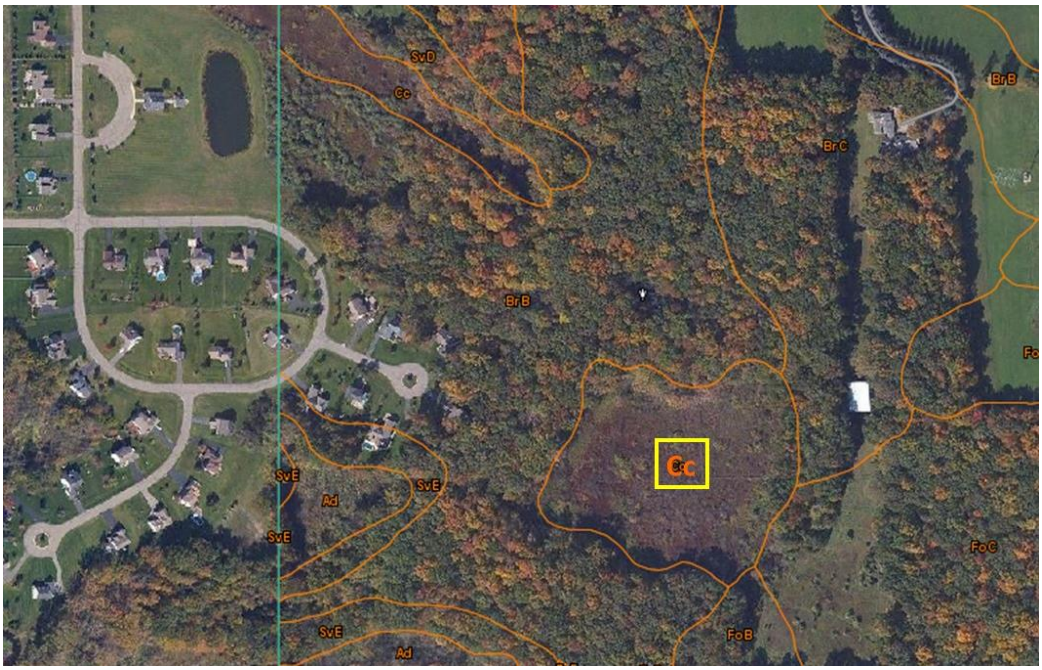

Figure 18. Soil map of tracts MI-LI-006.000, MI-LI-007.000, and MI-LI-007.500. Carlisle muck soils (Cc) underlay an extensive wetland that provides potential overwintering habitat for Massasaugas (see also Figures 8, 9, and 10).

Figure 19. Soil map of the Honey Creek floodplain. The wetlands on the north and south side of the creek are underlain by Tawas muck soils (Tm; see also Figures 12 and 13). The wetlands provide potential overwintering habitat for Massasaugas.

Rover Pipeline Eastern Massasauga Rattlesnake Detection Assessment Report

October 2015

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Contents

Project Overview

In October of 2015, Herpetological Resource and Management (HRM) was contracted by TRC to conduct detection surveys targeting rare reptile species along a proposed pipeline right of way (ROW). The Rover Pipeline project is a new interstate natural gas pipeline which will include direct deliveries into West Virginia, Ohio, Michigan, and Ontario, Canada. Within Michigan, the proposed pipeline would extend from the southern state border north into Washtenaw County and Livingston County where it will connect to the existing Vector pipeline.

The proposed pipeline project corridor extending into Michigan is known to support several rare and sensitive species of amphibians and reptiles (herpetofauna). Recent observations of the Eastern Massasauga Rattlesnake (*Sistrurus catenatus*) (EMR) are reported within close vicinity of the project area. This species is listed as Special Concern in Michigan, a federal candidate species and as of September 30, 2015 proposed for Federal Threatened status. Due to the likelihood of this sensitive species occurring within the project area and construction limits, efforts were taken to document their presence and provide recommendations to implement appropriate measures to mitigate potentially negative effects to rare herpetofauna. The objective of this work was to conduct presence/not detected surveys targeting EMR in the proposed pipeline ROW within Washtenaw and Livingston Counties. The scope of HRM's assessment was limited to five parcels, which were identified as priority areas for potential EMR occurrence through previous assessments.

Site Description

The area for this project extends approximately three miles between southern Livingston and northern Washtenaw Counties (Figure 1). The five parcels assessed for EMR presence are described below, from north to south.

MI-LI-019.000

This property in Livingston County is located south of State Route 36 and north of Mower Road. Honey Creek flows through the assessment area and connects with Mill Pond to the east. The floodplain surrounding the stream supports a variety of wetland species including several associated with fen communities. North of the creek, a large steep bank separates the floodplain from an open old field community. South of the creek, the proposed workspace intersects with an actively maintained Consumers Energy powerline ROW which supports additional old field communities.

MI-LI-007.000, MI-LI-006.000

In Livingston County, parcels 007.000 and 006.000 are west of Toma Road and north of Patterson Lake Road. A water treatment plant is directly east of parcel 007.000. In this northern parcel the proposed impact area extends through upland forest and multiple wetlands including one dominated by cattails and another with a more diverse species assemblage. Directly adjacent to the workspace, east of parcel 007.000 and north of 006.000 is an open old field community with sparse vegetation. As the ROW continues south into parcel 006.000 the habitat transitions to active agriculture which included recently harvested hay field at the time of survey. East of the workspace and hay field, a small open pond is located within a cattle enclosure dominated by short grasses and agronomic weeds managed low from cattle grazing.

MI-LI-004.570

Directly south of parcel 006.000 and Patterson Lake Road in Livingston County, this area includes a small residential house and yard in the northern portion. The ROW continues south through forested upland and shifts southeast for approximately 200 meters, skirting around a large vernal pool area. The assessment continues south through additional forested habitat until reaching a large wet sedge meadow.

MI-WA-120.000

In northern Washtenaw County, this parcel is located east of Dexter Townhall Road and Silver Lake. The proposed ROW extends from forested wetland in the south through an old field community and upland forest to the north of the parcel. A wet meadow habitat is east of the ROW with an open canopy. Directly north of the parcel is a larger, old field community adjacent to a shooting and archery range.

Methodology

Herpetofaunal surveys targeting rare and sensitive species were conducted on October 6 and 8, 2015 by a team of two to five biologists trained in the sampling and identification of amphibians and reptiles with expertise in detection of rare and sensitive species. Sampling was conducted during the EMR active period and under appropriate weather conditions for increased detection probability. Visual encounter surveys using meander transects were conducted within the ROW and adjacent high quality habitat within an approximately 400 foot-wide corridor to inventory suitable habitats and search for evidence of EMR (Photo 1). As part of the rare species survey, all herpetofauna encountered were documented.

Amphibians and reptiles observed during the survey were identified by visual characteristics. Each positively identified amphibian and reptile was documented and photos were taken when possible. Photos and notes were also taken to document the various habitat types and overall conditions present within the assessment area. Locations of detected individuals were recorded using Trimble Juno GPS units. All survey activities were in accordance with HRM's Scientific Collector's and Threatened and Endangered Species Permits issued by the State of Michigan.

Results and Discussion

During the assessment of the project area, HRM documented the presence of twelve species of herpetofauna including Eastern American Toad (*Bufo americanus*), Gray Treefrog (*Hyla versicolor/chrysoscelis*), Green Frog (*Rana clamitans*), Northern Leopard Frog (*Rana pipiens*), Northern Spring Peeper (*Pseudacris crucifer*), Western Chorus Frog (*Pseudacris triseriata*), Wood Frog (*Rana sylvatica*), Blue-spotted Salamander (*Ambystoma laterale*), Eastern Garter Snake (*Thamnophis sirtialis sirtalis*), Northern Ribbon Snake (*Thamnophis sauritus septentrionalis*), Eastern Snapping Turtle (*Chelydra serpentina*), and Midland Painted Turtle (*Chrysemys picta marginata*). The Eastern Massasauga Rattlesnake was not observed during HRM's fall 2015 surveys; however, the five parcels assessed appear suitable to support EMR and HRM documented conditions identified in previous project reports that support this (Davis 2015). These site features contained seasonal habitats required by EMR such as wetlands that provide opportunities for hibernation including crayfish burrows

(Photos 2, 3), open canopy meadow and field communities that are used during summer months for mate location, foraging, and neonate development (Photo 4), as well as evidence of prey items (Photo 5). The highest quality wetlands observed that have the most potential for supporting EMR during winter months included MI-LI-019.000 and MI-LI-004.570 (Photos 6, 7). Abundant crayfish burrows were observed at MI-LI-004.570, while none were observed at MI-LI-019.000; however, height of vegetation at time of survey impacted detection abilities and it is likely that crayfish are present and likely abundant based on quality of this wetland. Old field communities that have the highest probability of EMR detection due to habitat quality and sparse vegetation include the field located adjacent to the ROW in parcel MI-LI-007.000 and the actively used cattle pasture in the northeast corner of parcel MI-LI-006.000 (Photos 8, 9). Sites that contained evidence of not only small mammals but other important EMR prey items including amphibians and small snakes have a higher probability of supporting populations of the rattlesnake (Photo 10). A majority of the sites assessed contained this variety of prey items with the highest concentration observed in parcels MI-LI-004.570 and MI-WA-120.000. These factors all support previous findings that the five targeted parcels likely support EMR and indicate the value of conducting additional surveys during early spring when conditions are more ideal for species detection to provide a better understanding of potential EMR density within the project ROW.

The absence of EMR observations during HRM's assessments was likely a result of surveys being conducted at the end of the active period. This species returns to overwintering sites or migrates towards them by fall in Michigan. Though surveys were conducted during seasonally appropriate conditions, optimal survey time for this species is early spring as animals emerge from hibernation when multiple age classes and both sexes can be observed. Vegetation growth is also limited during spring months, which aids in detecting this cryptic and secretive species. Summer month surveys are ideal for targeting gravid adult females and young of year in upland grasslands and old field habitat. (Harding 1997; Johnson, Kingsbury et al. 2000; Casper, Anton et al. 2001).

The features described above that indicate the likelihood for EMR also form habitat that is suitable for supporting additional rare and sensitive species of herpetofauna including the state Threatened Spotted Turtle (*Clemmys guttata*) and Special Concern Blanding's Turtle (*Emydoidea blandingii*). Spotted Turtles prefer fen or high quality wet meadow habitat and associated vernal pools. The wet sedge meadow and nearby vernal pool wetland in parcel MI-LI-004.570 was identified during HRM's assessment as potential habitat for the species. The Blanding's Turtle has similar habitat requirements as Eastern Massasauga, utilizing a mosaic of natural communities throughout the year including a variety of wetlands and associated uplands (Photo 11). Blanding's Turtles can travel up to a mile over land to reach new habitat types. Based on HRM's site assessments and nearby occurrence records, Blanding's Turtles are likely to occur at parcels MI-LI-019.000, MI-LI-007.000, MI-LI-006.000, and MI-LI-004.570.

Regulations and Recommendations

In Michigan, all threatened and endangered species are afforded protection under Part 365 of the Natural Resources and Environmental Protection Act (NREPA Public Act 451 of 1994), administered by the MDNR Wildlife Division. Typically Special Concern species are not protected

under the State Endangered Species legislation; however, in Michigan amphibians and reptiles listed as Special Concern are protected under the MDNR Fisheries Division Order 224.13, which prohibits take or possession of these species from the wild without an appropriate permit. It is very likely that the ROW areas assessed as part of this project supports multiple species protected through these MDNR divisions and efforts should be made to minimize potential impacts. Proactive measures that can be taken during this project to minimize the short-term impacts to rare and sensitive reptiles within the project area include the installment of wildlife barrier fences, performance of daily site walk-downs, and relocation of target species outside of construction limits. Long-term measures that can benefit rare species and their habitat include prevention of invasive species through equipment cleaning, and creation of long-term wildlife corridors surrounding the project area.

EMR were not observed during HRM's surveys, however high quality habitat and recent nearby occurrences are present. Importantly, the absence of detection does not necessarily mean the absence of presence especially for the EMR. This species is notoriously very cryptic and shy and can be difficult to survey for. HRM recommends conducting additional presence surveys along the project using modified sampling methodology. The use of artificial cover objects (ACO) can be beneficial for sampling cryptic and hard to find species such as EMR (Photo 12). These cover objects also greatly improve collection efficacy when relocating specimens out of the construction corridor. Parcels that would particularly benefit from the placement include MI-WA-120.000, MI-LI-004.750, and MI-LI-019.000. Additionally prior to construction activities placement of cover objects will help in recovering snakes from within construction limits increasing detection rate and helping to reduce delays during project construction.

In addition to the use of ACOs for improved detection ability and to minimize risk of injury or mortality to rare target species, silt fence which is installed for sediment and erosion control can also be used in priority locations where there is a high likelihood of rare species presence including adjacent high quality habitat not located immediately within the ROW. By placing this fencing with at least 2 feet above ground, animals will be unable to enter construction limits (Photo 13). Terminal ends of barrier fences should have a half loop back swing to direct herpetofauna away from construction area (Photo 14). To maximize the effectiveness of barrier fencing, daily walk-downs of the proposed ROW priority areas can be conducted to determine if any rare reptiles are present. Prior to the walk-downs, training sessions should be held for project team members, contractors, and site supervisors to familiarize them with the target species, what to do if the species is encountered, and establishing a communication chain in the event that EMR or other rare species are observed. To ensure the safety of target species observed within the construction ROW, animals should be relocated to the other side of wildlife barrier fencing. EMR is a venomous species and to prevent injuries to both on-site workers and the animals themselves, a biologist experienced with this species should be consulted to relocate them.

Conclusion

The proposed Rover Pipeline has potential to impact rare and sensitive reptile species known to occur within the project area. It is the opinion of HRM that implementing the recommended best management practices will reduce potential impacts to target species. No EMR or other rare species likely to occur were observed during HRM's surveys. This is likely due to timing of sample efforts at the end of the active season for reptiles in Michigan. Based on habitat quality and nearby occurrences it is highly likely that EMR occur within the targeted work areas and HRM recommends that BMP's provided should be implemented. By performing additional site assessments, utilizing wildlife barrier fence, and conducting site walk-downs, HRM is confident that a majority of animals will be successfully maintained outside of the construction limits.

Figures

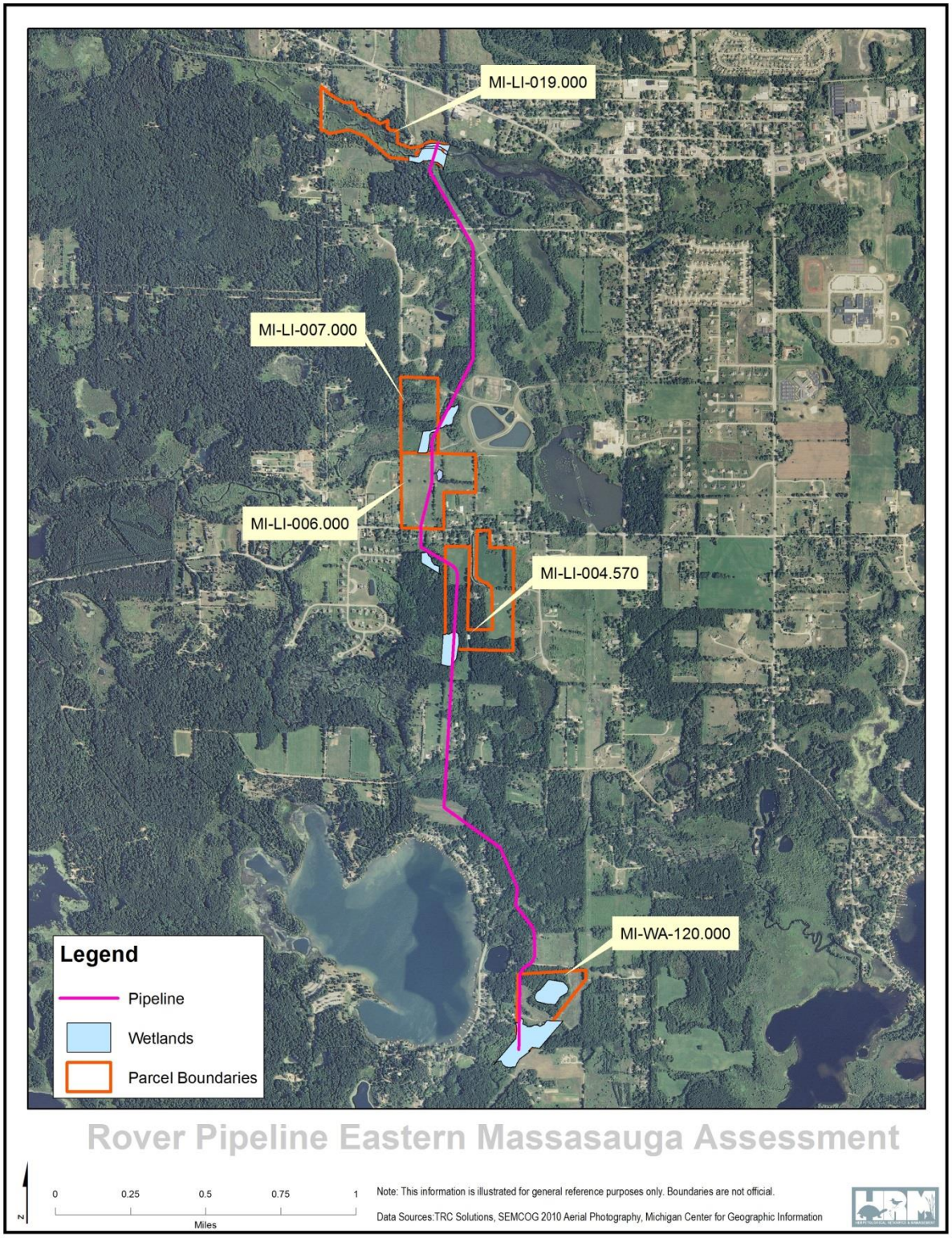

Figure 1. Overall project area including five targeted parcels, associated boundaries, and wetlands present.

Photos

Photo 1. HRM crew performing meander transects in high quality EMR habitat.

Photo 2. Wetland with potential to support EMR in Parcel 004.570.

Photo 3. Crayfish burrow observed in Parcel 004.570.

Photo 4. Upland old field community present in Parcel 019.000.

Photo 5. Dead star-nosed mole (*Condylura cristata*) observed in Parcel 019.000, indicating presence of available EMR food sources.

Photo 6. Wetlands present in the steam floodplain of Parcel 019.000 have a high probability of supporting EMR.

Photo 7. High quality wet meadow habitat with potential to support EMR hibernation in Parcel 004.570.

Photo 8. Herbacious vegetation in old field habitat in Parcel 007.000 with high potential for EMR occurrence.

Photo 9. Open pasture and small pond in Parcel 006.000 where EMR and Blanding's Turtle likely occur.

Photo 10. Younger age classes of EMR feed primarily on small prey such as this juvenile Northern Leopard Frog (*Rana pipiens*) observed in Parcel 007.000.

Photo 11. Wetland complex adjacent to Parcel 007.000 that has potential to support other rare reptiles including Blanding's Turtle.

Photo 12. The use of artificial cover objects can increase detection rates of cryptic species such as EMR.

Photo 13. Example of a wildlife barrier fence. These can be effective tools for keeping sensitive species outside of impact areas.

Photo 14. Looping the end portions of barrier fencing can further prevent animals from entering construction zones.

Species Profiles

Eastern Massasauga Rattlesnake

The Eastern Massasauga Rattlesnake is a Species of Special Concern in Michigan, and Endangered in all other States and Provinces where it occurs (Michigan Natural Features Inventory 2010; U.S. Fish and Wildlife Service 2014). It is a Federal Species of Special Concern and Candidate for elevated status under the Threatened and Endangered Species Act. Massasaugas require a mosaic of habitats that are used during different times of the year. Wetland communities including, fens, bogs, sedge meadows, and wet prairies are utilized from early fall until late spring where the snakes hibernate underground in crayfish chimneys or small mammal burrows (Harding 1997). Studies have shown high fidelity toward overwintering sites and they will often return to the same location each year (Johnson 2000; Smith 2009). They move to adjacent upland habitats including open shrubby fields and grasslands during the summer where warm weather provides opportunities for foraging and development of young (Harding 1997). Within the upland habitats, this species typically avoids closed canopy forests and those that do enter these areas are found where sunlight penetrates the canopy (Center for Reptile and Amphibian Conservation and Management). Home range and movement patterns are often site dependent making it important for project managers to understand what populations they are working with. Although this species is venomous, the first line of defense is its cryptic coloration and behavior (Harvey and Weatherhead 2006). This species is generally shy and unaggressive but is heavily persecuted by humans and often killed unnecessarily (Harding 1997). Populations of this species have declined rapidly in recent decades mainly as a result of habitat loss. Because it requires open upland habitat adjacent to wetlands, conservation and restoration efforts that focus solely on wetlands typically fail to preserve this species (Harding 1997).

Spotted Turtle

The Spotted Turtle is a Threatened Species in Michigan and listed as Endangered by the IUCN Red List (van Dijk 2011). It is in decline throughout its range largely due to extensive habitat loss; however, populations also face significant pressures from predation by subsidized predators as well as collection for the pet trade (Harding 1997; COSEWIC 2004; Holman 2012). The Spotted Turtle inhabits shallow ponds, wet meadows, fens, bogs, tamarack swamps, marshes, sphagnum seepages, and slow-moving streams. This species prefers areas with clear, shallow water with a mud bottom as well as abundant emergent and aquatic vegetation. Spotted Turtles are omnivorous; however, animal based diets are preferred including worms, mollusks, crayfish, insects, and tadpoles. Plant based foods are consumed less often and can include algae, tender plant leaves, and water lily seeds (Harding 1997). Hibernation occurs within wetland habitats, while adjacent upland areas are utilized for nesting as well as travelling between wetlands. The Spotted Turtle is tolerant of cooler water temperatures and is typically one of the first turtle species to become active in Michigan. Mating occurs immediately after emerging from hibernation in March or April, females construct nests in early to mid-June, and most young emerge from the nest in August or September. The species is known to show high site-fidelity for both hibernacula and 4 spring mating aggregations and will return to these same locations every year (COSEWIC 2004; Harding 1997; Holman 2012).

Blanding's Turtle

In Michigan, the Blanding's Turtle is listed as a Species of Special Concern. While stable in some parts of Michigan, this species is listed as Threatened and Endangered in other portions of the range, and it is currently being considered for federal protection. The Belle Isle population is relatively small and this species' natural history traits do not support annual mortality exceeding 4% for adults (Congdon, Dunham et al. 1993). This species requires a mosaic of wetland habitats for their survival. For much of the year, they prefer open water areas with structures such as logs or stumps to bask. Females require well drained soils, usually with southern exposure, for nesting and will travel long distances to locate a suitable nesting location. Hibernation occurs within ponds where the animals burrow into the mud below the frost line. The Blanding's Turtle has a life span of approximately 80 years, and does not reach sexual maturity until around 20 years of age. Adults have no natural predators, but hatchling and juvenile turtles suffer very high mortality rates. Annual nest predation by predators, especially raccoons, is often 100%. For this reason, it may take one adult female decades to produce enough turtles to replace herself and her mate and thus maintain a stable population. Due to their very low reproductive rate, it is extremely important to maintain ample nesting areas as well as floating leaved and shrub swamp wetland to shelter young Blanding's Turtles (Harding 1997; Carl H. Ernst 2009).

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